

CLAIMS

1. Method for the treatment of materials, in particular waste materials and refuse, in which the material to be treated and a combustion supporter comprising oxygen are supplied to an oxidation chamber or combustion reactor, and gases produced during the oxidation or combustion of the above-mentioned material are discharged from the oxidation chamber or combustion reactor, characterized in that the material to be treated, which is introduced into the oxidation chamber or combustion reactor, and the products resulting from the oxidation or combustion are subjected to conditions of isothermy or quasi-isothermy at high or very high temperature, without substantial oxygen deficit, in any part of the chamber or reactor.
2. Method for the treatment of materials according to Claim 1, characterized in that it comprises the supply of a combustion supporter comprising oxygen mixed with gases resulting from the combustion, with water, or with a combination of gases and water, to bring about a high degree of opacification of the combustion supporter and to ensure almost instantaneous heating of the combustion supporter that is supplied into the reactor.
3. Method for the treatment of materials according to Claim 2, characterized in that the recirculation gases resulting from combustion are supplied at minimized flow-rate and/or temperature so as to minimize the overall volume of gas in the reactor for a given time spent in the reactor by the gases and to ensure the removal of the reaction heat from the reactor.
4. Method for the treatment of materials according to Claim 2 or Claim 3, characterized in that the mixing of the oxygen

with the combustion fumes takes place with a concentration of the latter of more than 10% by volume and preferably more than 60% by volume.

5. Method for the treatment of materials according to any one of Claims 1 to 4, characterized in that the thermal exchange characteristic for IR (infra-red) radiation inside the reactor (10) is strengthened by increasing the concentration of gases that are opaque to IR and the volume density of the gases inside the reactor, in particular by increasing the total pressure of the combustion chamber.

6. Method for the treatment of materials according to any one of Claims 2 to 5, characterized in that the recirculation gases which ensure the thermal balance of a plant that is operated continuously by removing the excess reaction heat owing to an appreciable heat difference between the input and the output of the reactor are recycled at the minimum temperature that is compatible with normal cooling means and preferably just above the dew point.

7. Method for the treatment of materials according to any one of Claims 2 to 6, characterized in that the recycling gases which ensure the thermal balance are constituted wholly or partially by steam.

8. Method for the treatment of materials according to any one of Claims 1 to 7, characterized in that the reaction pressure is modulated in dependence on the type of material to be treated which is supplied into the reactor.

9. Method for the treatment of materials according to Claim 8, characterized in that the reaction pressure is modulated from atmospheric pressure to a greater pressure of about 600 kPa.

10. Method for the treatment of materials according to any one of Claims 1 to 9, characterized in that the substances which cannot be gasified inside the reactor are immediately fused in the reactor by virtue of the high rate of heating of the combustible material, in particular of its solid fraction, so as to reduce considerably the fraction of dust that is entrained out of the reactor with the burnt gases.

11. Method for the treatment of materials according to any one of Claims 1 to 10, characterized in that the fused slag is cooled and solidified into beads so as to ensure that toxic heavy metals contained in the incombustible slag are rendered completely inert.

12. Method for the treatment of materials according to any one of Claims 1 to 11, characterized in that it comprises a MIMO (multiple input/multiple output) control and optimization procedure which is focused on the parameters at the output of the reactor and in particular on the measurement of data relating to the composition of the gases at the output of the reactor.

13. Method for the treatment of materials according to Claim 12, characterized in that the measurements of the gas-composition data are implemented with characteristic response times of about 2 seconds.

14. Plant for the treatment of materials, in particular waste materials and refuse, comprising an oxidation chamber or combustion reactor (10) to which the material to be treated can be supplied and which includes an input (17) for a combustion supporter comprising oxygen and an output (34) for the gases produced during the oxidation or combustion of the above-mentioned material inside the chamber or reactor

(10), characterized in that the oxidation chamber or combustion reactor is substantially isothermal or quasi-isothermal in use at high or very high temperature, and without substantial oxygen deficit, in all of its parts.

15. Plant for the treatment of materials according to Claim 14, characterized in that the walls of the reactor (10) comprise a ceramic lining material which participates in the isothermy or quasi-isothermy of the reactor.

16. Plant for the treatment of materials according to Claim 14 or Claim 15, characterized in that it comprises means (26) for cooling the gases produced during combustion, means (29, 30) for withdrawing and recycling a portion of the said cooled gases being provided for mixing the oxygen at the input to the reactor (10) and producing a combustion-supporting mixture which is opaque to infra-red.

17. Plant for the treatment of materials according to Claim 16, characterized in that the cooling means (26) comprise means for recovering energy by the giving-up of heat by the gases output from the reactor (10).

18. Plant for the treatment of materials according to Claim 16 or Claim 17, characterized in that it comprises means (28) for mixing a portion of the recycled gases with the gases output from the reactor prior to their entry into the cooling means (26).

19. Plant for the treatment of materials according to any one of Claims 14 to 18, characterized in that it comprises means for maintaining a pressure greater than atmospheric pressure inside the reactor (10) in use.

20. Plant for the treatment of materials according to Claim 19, characterized in that it comprises means for selectively modulating the pressure inside the reactor substantially from atmospheric pressure to a pressure greater than atmospheric pressure, in dependence on the type of material supplied into the reactor, to ensure a hold-up of oxygen per unit volume of the reactor in every part of the reactor in use.

21. Plant for the treatment of materials according to any one of Claims 14 to 20, characterized in that it comprises a plurality of feeders (12, 14, 15, 16) for supplying different materials to the reactor (10), in particular, solid materials in pieces, granular materials, liquid or sludgy materials, and/or gaseous materials.

22. Plant for the treatment of materials according to Claim 21, characterized in that it comprises at least one propulsion chamber (13) for the pressurized and discontinuous supply of solid materials in pieces into the reactor (10).

23. Plant for the treatment of materials according to Claim 22, characterized in that the propulsion chamber comprises a duct (36) for the supply of gas under pressure, withdrawn from the output line (34).

24. Plant for the treatment of materials according to any one of Claims 14 to 23, characterized in that the reactor (10) comprises a base portion (21) communicating with and inclined towards a heated duct (22) for collecting fluid slag.

25. Plant for the treatment of materials according to Claim 24, characterized in that the collecting duct (22)

communicates with a container (24) for collecting the liquid slag which is cooled rapidly in a water bath with the formation of solid beads so as to form a very dilute sludge in water.

26. Plant for the treatment of materials according to Claim 24 or Claim 25, characterized in that the collecting duct (22) comprises heating means for keeping the slag fluid.

27. Plant for the treatment of materials according to any one of Claims 14 to 26, characterized in that it comprises sensor means for measuring output parameters of the reactor (10), a control and management system receiving the signals of the sensor means in order substantially to improve the number of effective predictions for intervention in the operating conditions of the plant and to control fluctuations due to the non-homogeneity of the materials that are supplied into the reactor.

28. Plant for the treatment of materials operating in accordance with the method according to any one of Claims 1 to 13.